

A New Eocene Lamnoid shark, *Carcharodon nodai*, from Omuta in Northern Kyushu, Japan

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Abstract A new fossil lamnoid shark, *Carcharodon nodai*, is described here from a bed of the Late Eocene Manda Group in Omuta City, Fukuoka Prefecture, Japan. This species differs from other species of the genus *Carcharodon* in having the coarse serrations on the cutting edges of the crown and the anterior cutting edge is entirely convex in the outline.

Fossil teeth belonging to several species of the genus *Carcharodon* have been found from Oligocene to Pleistocene in Japan; *Carcharodon angustidens* from Oligocene in Kitakyushu (UYENO *et al.*, 1984, YABUMOTO, 1987), *C. sulcidens* from Miocene in Mie Prefecture (UYENO *et al.*, 1980), *C. akitaensis* from Miocene in Akita Prefecture (UYENO and HASEGAWA, 1974), *C. megalodon* from Miocene to Pliocene in more than 40 localities ranging from Hokkaido to Miyakojima Island of the Ryukyu Islands (GOTO, 1972; UYENO *et al.*, 1974; UYENO *et al.*, 1989) and *C. carcharias* from Pliocene to Pleistocene in Kochi, Shizuoka, Kanagawa, Chiba, Fukushima and Niigata Prefecture (UYENO *et al.*, 1975; UYENO and MATSUSHIMA, 1975, 1979; KUGA, 1985; ITOIGAWA *et al.*, 1975; SASAGAWA *et al.*, 1989).

In April, 1989, I visited Mr. Sakae NODA to investigate his collection of fossil shark teeth in Omuta City, Fukuoka Prefecture. In his collection, there was a peculiar fossil tooth belonging to the genus *Carcharodon*. Since I recognize that this specimen differs from other species of the genus *Carcharodon*, I describe here as a new species.

Acknowledgments

I like to express my sincere gratitude to Dr. Teruya UYENO of National Science Museum for his invaluable advice and critical reading of the manuscript. I am very grateful to Mr. Sakae NODA for the donation of the specimen. I am also grateful to Dr. Ryuzo TORIYAMA and Dr. Masamichi OTA of Kitakyushu Museum of Natural History for their constant encouragement.

Class Chondrichthyes

Order Lamniformes

Family Lamnidae

Carcharodon nodai sp. nov.

(Pl. 1, Fig. 3)

Holotype specimen. KMNH (Kitakyushu Museum of Natural History) VP 100,145. This specimen was collected in 1978 and donated to the Kitakyushu Museum of Natural History by Mr. Sakae NODA in 1989. The specimen is considered to be a left lower jaw tooth. The basal part and the surface of the root and some parts of both cutting edges are missing.

Horizon. The Kattachi Formation in the Manda Group, Upper Eocene.

Type locality. Kattachi (130°28'52"E, 33°00'45"N) in Omuta City, Fukuoka Prefecture (Fig. 1). The locality is in the southern part of Fukuoka Prefecture. The

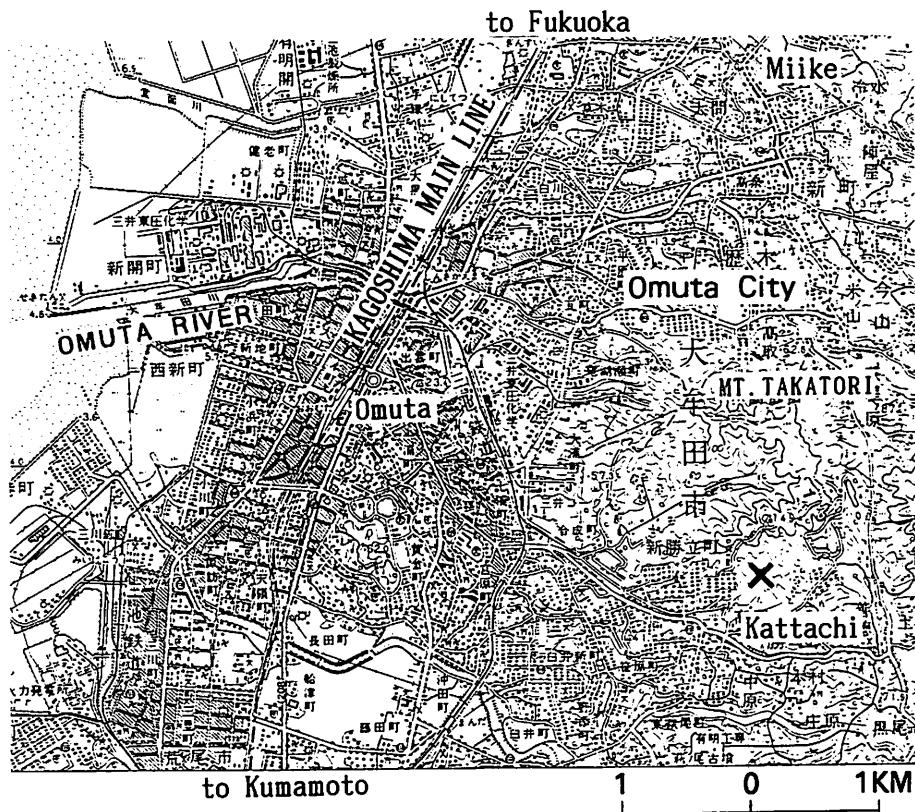


Fig. 1. Map showing the locality (X) of *Carcharodon nodai* sp. nov. Kattachi, Omuta City in Fukuoka Prefecture.

Manda Group was first described by NAGAO (1926) and has been studied by several geologists (e.g. MATSUSHITA, 1949a; 1949b; KIHARA, 1960; KIKUCHI, 1963a; 1963b). According to MATSUSHITA (1949a; 1949b), the Manda Group is predominantly sand-stone, of which, the rocks of the lower part (the Kattachi Formation) are glauconitic and fossiliferous, and those of the upper part (the Yotsuyama Formation) are fine-grained. The Kattachi Formation yielded marine molluscs, *Crassatellites fuscus*, *Venericardia nipponica*, *V. mandaica* and others (MATSUSHITA, 1949a; 1949b).

Etymology. The specific name is taken from Mr. Sakae NODA who collected and donated the specimen.

Diagnosis. This species differs from other species of the genus *Carcharodon* in having combination of following characters, 1) the coarse serrations (6–7 indentations within 10 mm distance at the middle) on the both cutting edges, 2) the anterior cutting edge convex entirely (without concave part near the root) in the outline, 3) the lateral cusplets are present, 4) the crown thickness 27.2% of the crown length, 5) well developed neck region.

Description of the holotype specimen.

The crown is strongly inclined to the rear and the angle between vertical line crossing the line between anterior and posterior ends of the crown base of the labial

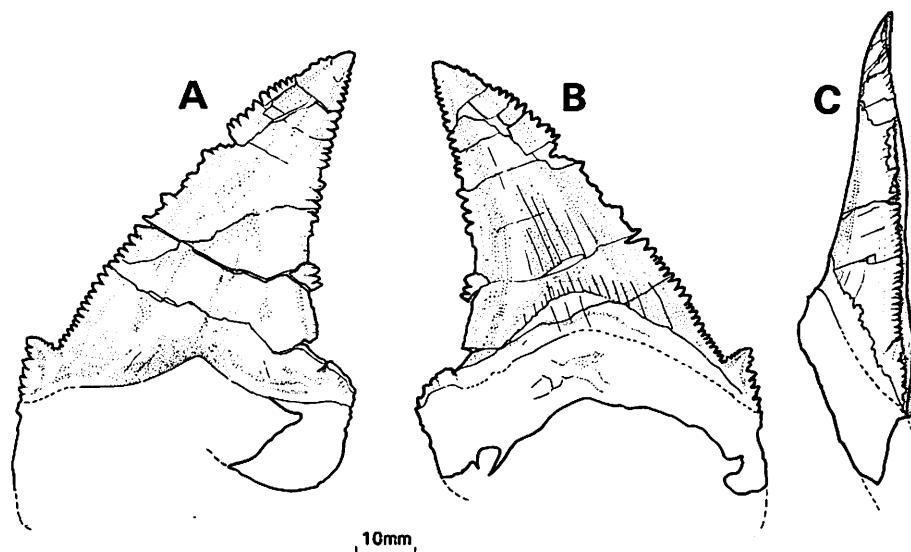


Fig. 2. *Carcharodon nodai* sp. nov., holotype (KMNH VP 100,145) from Kattachi, Omata City in Fukuoka Prefecture. A, the labial surface; B, the lingual surface; C, the view of the anterior cutting edge.

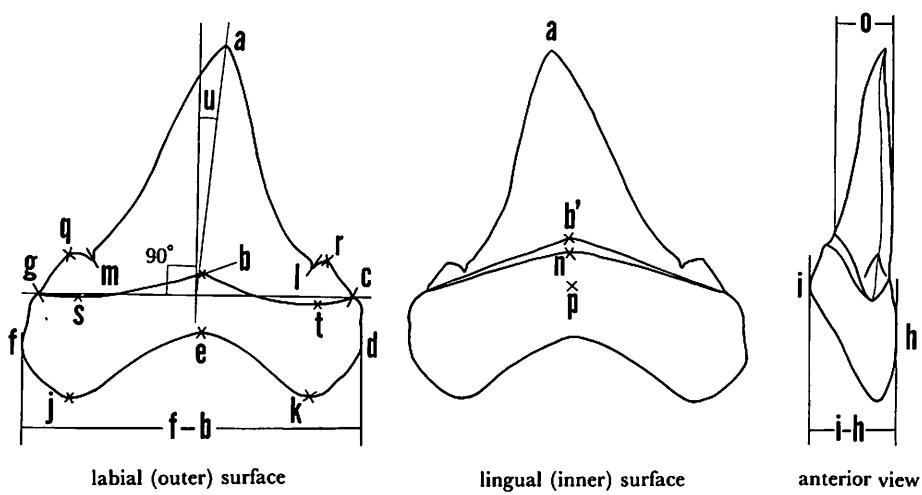


Fig. 3. The method of the measurements of a fossil tooth of *Carcharodon* (from YABUMOTO, 1987).

Table 1. The measurements of the holotype specimen of *Carcharodon nodai* sp. nov. from Omuta City, Fukuoka Prefecture.

a-b	54.4 mm	b'-n	7.3	p	15.0+
a-b'	44.9	m-l	42.6	a-m	66.5
a-c	57.7	m-g	11.5	a-l	50.6
a-g	78.2	l-c	8.8	u	25°
a-k	70.7	g-s	11.7		
c-g	53.4	o	14.8		

(outer) face and the line from the center of the line between anterior and posterior ends of the crown base to the apex is 25 degree (Fig. 3; u). Some parts of both cutting edges are missing, but the total number of serrations can be estimated. The anterior cutting edge is convex entirely in the outline. There is no concave part on the anterior cutting edge near the root. The posterior cutting edge is concave in the outline. Serrations are coarser in the middle parts of both cutting edges, and finer in the upper and lower parts. The anterior cutting edge has 6-7 indentations within each 10 mm distance at the middle part, 10 near the root and 9 close to the apex respectively. There are 38 serrations on the anterior cutting edge and the total is estimated to be 56. About 2 mm of the anterior cutting edge is missing at the middle in the position slightly closer to the apex of the crown. The posterior cutting edge has 6-7 indentations at the middle part and 10 indentations near the apex within 10 mm distance. Twenty four serrations are preserved on the posterior cutting edge and the total is estimated to be 43 or 44. About 4 mm of the posterior cutting edge

is missing near the posterior cusplet. The lingual (inner) surface of the crown is convex and the central part is flattish. The labial surface of the crown is almost flat, but slightly convex near the apex. The basal part of the labial surface is deeply concave at the center and is convex at the anterior and posterior parts. A weak ridge runs upward from the center of the crown base. The base of serration along the anterior cutting edge is concave on the labial surface of the crown. The anterior cusplet has 9 serrations (5 serrations are coarse) on the anterior cutting edge, 8 fine serrations on the posterior cutting edge and one on the apex. Three serrations are preserved on both edges and one on the apex of the posterior cusplet. The tooth neck is wide at the central part and gradually narrows toward the anterior and the posterior. The lower part of the root is missing and the surface is entirely missing. The central part of the root appears to be convex.

Remarks

The systematic considerations of the Cenozoic large shark teeth having serrated cutting edges are different in several workers (CAPPETTA, 1987). The disagreement is caused by the different selection of synapomorphy. In the present paper, these fossil sharks are placed in one genus, *Carcharodon*.

Among the species of the genus, *Carcharodon nodai* is closer to *Carcharodon angustidens* (AGASSIZ) from the Oligocene sediments in the Ashiya Group, northern Kyushu (UYENO *et al.*, 1984; YABUMOTO, 1987) in the size and having lateral cusplets, but differs from *C. angustidens* in the crown shape and having coarse serrations on the cutting edges. The outline of the anterior cutting edge is convex entirely without concave part near the root in *C. nodai*. In *C. angustidens*, the anterior cutting edge has a concave part near the root in the outline. *C. nodai* is also similar to *Carcharodon landanensis* LERICHE (illustrated by CAPPETTA, 1987) from the Paleocene West Africa in the crown shape and having coarse serrations on the cutting edges, but differs from *C. landanensis* in the size and having fine serrations on the cutting edges near the root. The height of the crown is 54.4 mm in *C. nodai*. In *C. landanensis*, the height of the crown is about 2.5 mm and the serrations on the cutting edges near the root are coarse.

Literature Cited

CAPPETTA, H. 1987. Chondrichthyes II. Mesozoic and Cenozoic Elasmobranchii. Handbook of Paleoichthyology, 3B: 1-193, Gustav Fisher, Stuttgart.

GOTO, M. 1972. Fossil Chondrichthyes of Japan. *J. Geol. Soc. Japan* 78 (11): 585-600. (In Japanese).

ITOIGAWA, J., H. NISHIMOTO, M. KURODA, H. HORIE, A. NARUSE and Y. WATANABE. 1975. *Carcharodon carcharias* (LINNÉ) —shark teeth— from the Pliocene Na-arai Formation, Choshi Peninsula, environs of Tokyo, Japan. *Bull. Mizunami Fossil Mus.* (2): 91-101, figs. 1-4, pls. 19-22. (In Japanese).

KIHARA, T. 1960. Relation between the Paleogene coal-bearing and marine formations along the

Eastern coast of the Ariake Sea, Kyushu. *Sci. Rep. Tohoku Univ.*, 2nd Ser. (Geol.) , Spec. Vol., (4): 515-522, fig. 1. (In Japanese).

KIKUCHI, H. 1963a. Study on the stratigraphy and sedimentation environment in the Miike coal field. *Min. Geol.* **13** (57): 8-19, figs. 1-7. (In Japanese).

KIKUCHI, H. 1963b. Study on the tectonic movements in the Miike coal field. *Min. Geol.* **13** (57): 20-29, figs. 1-5. (In Japanese).

KUGA, N. 1985. A note on faunal succession of the Tertiary elasmobranchs in Japan. in GOTO, M. et al.; Evolution and Adaptation of Marine Vertebrates. Assoc. Geol. Collabor., Japan: 37-44, fig. 1. (In Japanese).

MATSUSHITA, H. 1949a. A summary of the Palaeogene stratigraphy of northern Kyushu. *Mem. Faculty of Science, Kyushu Univ.*, Ser. D, **3** (2): 91-107, 1 fig., tabs. 1-8.

MATSUSHITA, H. 1949b. Geology of the coal fields in northern Kyushu. *J. Mining Inst., Kyushu*, Spec. Paper, 57 pp., figs. 1-8. (In Japanese).

NAGAO, T. 1926. Palaeogene stratigraphy of Kyushu, Japan. part 6. *Japan. Jour. Geogr.* (452): 596-601, figs. 10-14, pl. 2. (In Japanese).

SASAGAWA, I., S. YASUI and M. GOTO. 1989. Fossil teeth of the great white shark, *Carcharodon carcharias*, found from the Uonuma Group in Tokiya, Nagaoka City, Central Japan. *Bull. Nagaoka Municipal Sci. Mus.* (24): 1-6, figs. 1-5. (In Japanese).

UYENO, T. and Y. HASEGAWA. 1974. A new Miocene lamnid shark, *Carcharodon akitaensis*, from Central Japan. *Bull. Natn. Sci. Mus.*, Tokyo, **17** (3): 257-260, figs. 1-3, pl. 1.

UYENO, T., Y. HASEGAWA and T. KAKUTA. 1980. Some shark teeth from Miocene Ichishi Formation in Mie Prefecture, Japan. *Bull. Natn. Sci. Mus.*, Ser. C(Geol.), **6** (4): 125-128, pls. 1-2.

UYENO, T., Y. HASEGAWA, T. NOHARA, and A. ADANIYA. 1974. A fossil shark tooth of *Carcharodon megalodon* from Miyako-jima. (Studies of the palaeovertebrate fauna of Ryukyu Islands, Japan. Part V.). *Mem. Natn. Sci. Mus.* (7): 61-64, figs. 1-2. (In Japanese).

UYENO, T., N. KASHIMA and Y. HASEGAWA. 1975. Fossil shark teeth from Cretaceous and Tertiary beds in Shikoku Island, Japan. *Mem. Natn. Sci. Mus.* (8): 52-56, figs. 1-2, pl. 5. (In Japanese).

UYENO, T. and Y. MATSUSHIMA. 1975. Pliocene shark remains of *Carcharodon*, *Carcharhinus* and *Dalatias* from Kanagawa Prefecture, Japan. *Bull. Kanagawa Pref. Mus.* (8): 41-55, figs. 1-4, pls. 1-4. (In Japanese).

UYENO, T. and Y. MATSUSHIMA. 1979. Comparative study of teeth from Naganuma Formation of Middle Pleistocene and Recent specimens of great white shark, *Carcharodon carcharias* from Japan. *Bull. Kanagawa Pref. Mus.* (11): 11-30, figs. 1-9, pls. 1-8. (In Japanese).

UYENO, T., O. SAKAMOTO and H. SEKINE. 1989. Description of an almost complete tooth set of *Carcharodon megalodon* from a Middle Miocene bed in Saitama Prefecture, Japan. *Bull. Saitama Mus. Nat. Hist.* (7): 73-85, figs. 1-6, pls. 1-16. (In Japanese).

UYENO, T., Y. YABUMOTO and N. KUGA. 1984. Fossil fishes of Ashiya Group-(I). Late Oligocene Elasmobranchs from Islands of Aoshima and Kaijima, Kitakyushu. *Bull. Kitakyushu Mus. Nat. Hist.* 5: 135-142, pls. 1-5. (In Japanese).

YABUMOTO, Y. 1987. Oligocene lamnid shark of the genus *Carcharodon* from Kitakyushu, Japan. *Bull. Kitakyushu Mus. Nat. Hist.* 6: 239-264, figs. 1-18, pls. 1-4.

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Plate 1

Explanation of Plate 1

The holotype of *Carcharodon nodai* sp. nov.

1. The labial (outer) surface.
2. The lingual (inner) surface.
3. The view of the anterior cutting edge.

All natural size.

The natural form of the root is not clear (see Figure 2)

